IN THE CLAIMS:

Following is a replacement claim set. Claims 1-12 and 18-28 are withdrawn from consideration, while claims 29-39 are new.

1. (Withdrawn) An apparatus for controlling the temperature and humidity of a gas stream comprising:

an evaporator chamber having a water inlet flow controller, an ultrasonic mister and one or more ports for the delivery of water vapor and the return of condensate; and

a gas humidifying chamber in fluid communication with the one or more ports of the evaporator chamber, the gas humidifying chamber having a gas inlet, elements arranged in the gas humidifying chamber to return condensate to at least one of the one or more evaporator chamber ports and a humidified gas outlet.

2. (Withdrawn) The apparatus of claim 1, further comprising one or more heaters for heating the gas disposed at locations selected from between the humidification chamber and the evaporation chamber, before the gas inlet, after the gas outlet, or combinations thereof

3. (Withdrawn) The apparatus of claim 1, further comprising one or more temperature sensor wherein each of the one or more heaters has one of the one or more temperature sensors disposed at the heater outlet.

4. (Withdrawn) The apparatus of claim 1, further comprising one or more temperature controllers, wherein each of the one or more heaters is controlled by one of the one or more temperature controllers.

5. (Withdrawn) The apparatus of claim 1, wherein the elements arranged in the humidification chamber are selected from a demister pad, baffles, perforated baffles, trays, packing or combinations thereof.

6. (Withdrawn) The apparatus of claim 1, wherein the water inlet flow controller controls a device selected from a control valve and a metering pump.

7. (Withdrawn) The apparatus of claim 1, wherein the evaporator chamber port provides restricted fluid communication between the evaporator chamber and the gas humidifying chamber.

8. (Withdrawn) The apparatus of claim 1, wherein the evaporator chamber port provides a sufficiently small opening to substantially prevent passage of the gas into the evaporator chamber during use.

9. (Withdrawn) The apparatus of claim 1, wherein the evaporator chamber port comprises an orifice.

10. (Withdrawn) The apparatus of claim 1, further comprising a humidistat, wherein the humidistat provides feedback to a humidification controller having an output to an oscillator.

11. (Withdrawn) The apparatus of claim 10, the ultrasonic mister comprising a transducer having a metal disk that vibrates in response to an electrical signal from the oscillator, wherein the transducer is submerged in the evaporator chamber, and wherein the vibration produces minute droplets of water.

12. (Withdrawn) The apparatus of claim 1, further comprising:

water vapor conveyance means selected from piping or tubing;

side ports in the humidifying chamber in fluid communication with the evaporator chamber; and

wherein the conveyance means delivers water vapor from the one or more ports of the evaporation chamber to the humidifying chamber side ports.

13. (Original) A method for humidifying a reactant gas stream for use in a fuel cell comprising:

passing the reactant gas stream through a humidification chamber;

providing liquid water into an evaporator chamber at a mass flow rate to produce water vapor at a mass flow rate in relation to the liquid water mass flow rate;

communicating the water vapor from the evaporator chamber into the humidification chamber for humidifying the reactant gas stream;

monitoring one or more parameters of the fuel cell operation; and

changing the flow rate of the liquid water to maintain a setpoint value for the one or more parameters, wherein the one or more parameters are selected from the group consisting of humidified reactant gas dew point temperature, humidified reactant gas pressure, applied load, fuel cell voltage, fuel cell stack voltage, the extent of membrane hydration and combinations thereof.

14. (Original) The method of claim 13, further comprising:

monitoring the performance of the fuel cell while changing the flow rate of the water in proportion to the flow rate of the reactant gas stream.

15. (Original) The method of claim 13, further comprising:

monitoring the temperature of the water vapor, and maintaining the temperature of the water vapor at a set point temperature.

16. (Original) The method of claim 13, further comprising:

monitoring the performance of the fuel cell while changing the set point temperature of the humidified reactant gas stream.

17. (Original) The method of claim 13, further comprising:

monitoring the evaporation rate of the water in the evaporation chamber; and

adjusting the amount of water provided to the evaporation chamber based on the evaporation

rate of water in the evaporation chamber.

18. (Withdrawn) An apparatus for controlling the temperature and humidity of a gas stream comprising:

an evaporator chamber having an inlet flow controller, a heater and a port for delivery of water vapor and the return of condensate;

a gas humidifying chamber in fluid communication with the evaporator chamber port, the gas humidifying chamber having a gas inlet, elements arranged in the gas humidifying chamber to return condensate to the evaporator chamber port and a humidified gas outlet; and

additional heaters disposed at locations selected from between the humidification chamber and the evaporation chamber, before the gas inlet, after the gas outlet, or combinations thereof.

19. (Withdrawn) An apparatus for controlling the temperature and humidity of a gas stream comprising:

an evaporator chamber having a water inlet flow controller and an ultrasonic mister; and

a gas humidifying chamber disposed above the evaporator chamber, the gas humidifying chamber having a gas inlet, elements arranged in the gas humidifying chamber to return condensate to the evaporator chamber and a humidified gas outlet, wherein the evaporator chamber and the gas humidifying chamber are within a common vessel.

20. (Withdrawn) The apparatus of claim 19, further comprising one or more heaters for heating the gas disposed at locations selected from before the gas inlet, after the gas outlet, or combinations thereof

21. (Withdrawn) The apparatus of claim 19, further comprising a one or more temperature sensor wherein each of the one or more heaters has one of the one or more temperature sensors disposed at the heater outlet.

22. (Withdrawn) The apparatus of claim 19, further comprising one or more temperature controllers, wherein each of the one or more heaters is controlled by one of the one or more temperature controllers.

23. (Withdrawn) The apparatus of claim 19, wherein the elements arranged in the humidification chamber are selected from a demister pad, baffles, perforated baffles, trays, packing or combinations thereof.

24. (Withdrawn) The apparatus of claim 19, further comprising a humidistat, wherein the humidistat provides feedback to a humidification controller having an output to an oscillator.

25. (Withdrawn) The apparatus of claim 24, the ultrasonic mister comprising a transducer having a metal disk that vibrates in response to an electrical signal from the oscillator, wherein the transducer is submerged in the evaporator chamber, and wherein the vibration produces minute droplets of water.

26. (Withdrawn) The apparatus of claim 19, further comprising means for injecting steam into the humidification chamber.

27. (Withdrawn) The apparatus of claim 26, further comprising a controller for controlling an amount of steam injected, wherein the controller setpoint is determined by one or parameters selected from the group consisting of humidified reactant gas dew point temperature, humidified reactant gas pressure, applied load, fuel cell voltage, fuel cell stack voltage, the extent of membrane hydration and combinations thereof.

28. (Withdrawn) The apparatus of claim 19, further comprising a cooling heat exchanger after the gas outlet, wherein the gas dew point is controlled by cooling the gas.

29. (New) The method of claim 13, wherein the reactant gas stream is passed through the humidification chamber at a flow rate required to operate the fuel cell.

30. (New) The method of claim 13, wherein the water vapor is communicated from the evaporator chamber into the humidification chamber through an orifice.

31. (New) The method of claim 13, wherein the mass flow rate of the water vapor is in relation to the flow rate of the reactant gas stream.

32. (New) The method of claim 13, further comprising monitoring the performance of the fuel cell while changing the flow rate of the water vapor.

33. (New) The method of claim 13, further comprising transferring heat between the reactant gas stream and the water vapor.

34. (New) The method of claim 13, further comprising superheating the water vapor.

35. (New) The method of claim 13, further comprising condensing water vapor from the reactant gas stream in the humidification chamber.

36. (New) The method of claim 13, further comprising: providing a gas transfer line from the humidification chamber to an outlet for communication with the fuel cell; and maintaining the gas transfer line temperature in relation to the outlet gas temperature.

37. (New) The method of claim 13, further comprising: providing a gas transfer line from the humidification chamber to an outlet for communication with the fuel cell; and maintaining the gas transfer line temperature in relation to the outlet gas dewpoint temperature.

38. (New) The method of claim 13, further comprising: providing a gas transfer line from the humidification chamber to an outlet for communication with the fuel cell; and heating the gas transfer line to prevent condensation of water vapor.

39. (New) The method of claim 13, further comprising monitoring the temperature of the humidified gas stream; and maintaining the temperature of humidified gas stream at a set-point temperature.